

WHAT IS CLAIMED IS:

1. A vehicle motion control method for executing steering control or drive power control for the vehicle based on steering characteristic of the vehicle obtained based on the behavior amount of the vehicle which occurs around an axis in the vertical direction with respect to the vehicle body, comprising:

behavior amount acquiring step of acquiring the behavior amount of said vehicle;

differentiation step of obtaining a behavior amount

differentiated value by differentiating said behavior amount; and

steering characteristic determination step of determining said vehicle steering characteristic based on said behavior amount differentiated value.

2. The vehicle motion control method according to claim 1 wherein said behavior amount is a difference in angle between the front wheel slip angle of a front wheel of said vehicle and the rear wheel slip angle of a rear wheel of said vehicle.

3. The vehicle motion control method according to claim 1 wherein said steering characteristic determination step contains over-steer characteristic determination step in which even if said behavior amount falls under the under-steer characteristic, if it exceeds a predetermined under-steer determination value in the vicinity of neutral steer determination value while said behavior amount differentiated value is positive, it is determined that the steering characteristic is over-steer; and

under-steer characteristic determination step in which even if said behavior amount falls under the over-steer characteristic, if it is below a predetermined over-steer determination value in the vicinity of neutral steer determination value while said behavior amount differentiated value is negative, it is determined that the steering characteristic is under-steer.

4. The vehicle motion control method according to claim 2 wherein said steering characteristic determination step contains over-steer characteristic determination step in which even if said behavior amount falls under the under-steer  
5 characteristic, if it exceeds a predetermined under-steer determination value in the vicinity of neutral steer determination value while said behavior amount differentiated value is positive, it is determined that the steering characteristic is over-steer; and

10 under-steer characteristic determination step in which even if said behavior amount falls under the over-steer characteristic, if it is below a predetermined over-steer determination value in the vicinity of neutral steer determination value while said behavior amount  
15 differentiated value is negative, it is determined that the steering characteristic is under-steer.

5. The vehicle motion control method according to any one of claims 1 further comprising:

20 object control amount arithmetic operation step of computing an object control amount which is an object value for the steering control or drive power control of said vehicle; proportional control amount arithmetic operation step of computing a proportional control amount based on a difference between said behavior amount and said object control amount;  
25 and

proportional control amount zero setting step for, when said proportional control amount acts on control which intensifies the over-steer when the over-steer of said vehicle is suppressed, setting the proportional control amount to  
30 substantially zero.

6. The vehicle motion control method according to any one of claims 2 further comprising:

object control amount arithmetic operation step of computing an object control amount which is an object value for the

steering control or drive power control of said vehicle;  
proportional control amount arithmetic operation step of  
computing a proportional control amount based on a difference  
between said behavior amount and said object control amount;  
5 and

proportional control amount zero setting step for, when said  
proportional control amount acts on control which intensifies  
the over-steer when the over-steer of said vehicle is  
suppressed, setting the proportional control amount to  
10 substantially zero.

7. The vehicle motion control method according to any one  
of claims 3 further comprising:

object control amount arithmetic operation step of computing  
an object control amount which is an object value for the  
steering control or drive power control of said vehicle;  
15 proportional control amount arithmetic operation step of  
computing a proportional control amount based on a difference  
between said behavior amount and said object control amount;  
and

20 proportional control amount zero setting step for, when said  
proportional control amount acts on control which intensifies  
the over-steer when the over-steer of said vehicle is  
suppressed, setting the proportional control amount to  
substantially zero.

25 8. The vehicle motion control method according to any one  
of claims 1 wherein said steering control is carried out by  
transmission ratio changing control step for controlling the  
transmission ratio changing means which is located in the midway  
of steering transmission system connecting the steering wheel  
30 to the steered vehicle wheel for changing the transmission ratio  
by driving an electric motor.

9. The vehicle motion control method according to any one  
of claims 2 wherein said steering control is carried out by  
transmission ratio changing control step for controlling the

transmission ratio changing means which is located in the midway of steering transmission system connecting the steering wheel to the steered vehicle wheel for changing the transmission ratio by driving an electric motor.

5 10. The vehicle motion control method according to any one of claims 3 wherein said steering control is carried out by transmission ratio changing control step for controlling the transmission ratio changing means which is located in the midway of steering transmission system connecting the steering wheel  
10 to the steered vehicle wheel for changing the transmission ratio by driving an electric motor.

11. The vehicle motion control method according to any one of claims 4 wherein said steering control is carried out by transmission ratio changing control step for controlling the  
15 transmission ratio changing means which is located in the midway of steering transmission system connecting the steering wheel to the steered vehicle wheel for changing the transmission ratio by driving an electric motor.

12. A vehicle motion control apparatus for executing steering  
20 control or drive power control for the vehicle based on steering characteristic of the vehicle obtained based on the behavior amount of the vehicle which occurs around an axis in the vertical direction with respect to the vehicle body, comprising:

behavior amount acquiring means for acquiring the behavior  
25 amount of said vehicle;

differentiation means for obtaining a behavior amount differentiated value by differentiating said behavior amount; and

steering characteristic determination means for determining  
30 said vehicle steering characteristic based on said behavior amount differentiated value.

13. The vehicle motion control apparatus according to claim 6 wherein said behavior amount is a difference in angle between the front wheel slip angle of a front wheel of said vehicle and

the rear wheel slip angle of a rear wheel of said vehicle.

14. The vehicle motion control apparatus according to claim 6 wherein said steering characteristic determination means includes over-steer characteristic determination means in which even if said behavior amount exceeds a predetermined under-steer determination value while said behavior amount differentiated value is positive, it is determined that the steering characteristic is over-steer; and

under-steer characteristic determination means in which even if said behavior amount is below a predetermined over-steer determination value while said behavior amount differentiated value is negative, it is determined that the steering characteristic is under-steer.

15. The vehicle motion control apparatus according to claim 7 wherein said steering characteristic determination means includes over-steer characteristic determination means in which even if said behavior amount exceeds a predetermined under-steer determination value while said behavior amount differentiated value is positive, it is determined that the steering characteristic is over-steer; and

under-steer characteristic determination means in which even if said behavior amount is below a predetermined over-steer determination value while said behavior amount differentiated value is negative, it is determined that the steering characteristic is under-steer.

16. The vehicle motion control method according to any one of claims 6 further comprising:

object control amount arithmetic operation means for computing an object control amount which is an object value for the steering control or drive power control of said vehicle;

proportional control amount arithmetic operation means for computing a proportional control amount based on a difference between said behavior amount and said object control amount;

and

proportional control amount zero setting means for, when said proportional control amount acts on control which intensifies the over-steer when the over-steer of said vehicle is suppressed, setting the proportional control amount to substantially zero.

17. The vehicle motion control method according to any one of claims 7 further comprising:

object control amount arithmetic operation means for computing an object control amount which is an object value for the steering control or drive power control of said vehicle;

proportional control amount arithmetic operation means for computing a proportional control amount based on a difference between said behavior amount and said object control amount;

and

proportional control amount zero setting means for, when said proportional control amount acts on control which intensifies the over-steer when the over-steer of said vehicle is suppressed, setting the proportional control amount to substantially zero.

18. The vehicle motion control method according to any one of claims 8 further comprising:

object control amount arithmetic operation means for computing an object control amount which is an object value for the steering control or drive power control of said vehicle;

proportional control amount arithmetic operation means for computing a proportional control amount based on a difference between said behavior amount and said object control amount;

and

proportional control amount zero setting means for, when said proportional control amount acts on control which intensifies the over-steer when the over-steer of said vehicle is suppressed, setting the proportional control amount to substantially zero.

19. The vehicle motion control apparatus according to any

one of claims 6 wherein said steering control is carried out by transmission ratio changing control means for controlling the transmission ratio changing means which is located in the midway of steering transmission system connecting the steering wheel to the steered vehicle wheel for changing the transmission ratio by driving an electric motor.

20. The vehicle motion control apparatus according to any one of claims 7 wherein said steering control is carried out by transmission ratio changing control means for controlling the transmission ratio changing means which is located in the midway of steering transmission system connecting the steering wheel to the steered vehicle wheel for changing the transmission ratio by driving an electric motor.

21. The vehicle motion control apparatus according to any one of claims 8 wherein said steering control is carried out by transmission ratio changing control means for controlling the transmission ratio changing means which is located in the midway of steering transmission system connecting the steering wheel to the steered vehicle wheel for changing the transmission ratio by driving an electric motor.

22. The vehicle motion control apparatus according to any one of claims 9 wherein said steering control is carried out by transmission ratio changing control means for controlling the transmission ratio changing means which is located in the midway of steering transmission system connecting the steering wheel to the steered vehicle wheel for changing the transmission ratio by driving an electric motor.